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The treatment of lateral curvature of the spine presents the most difficult problem in the orthopedic surgery of to-day. This is, in part, because of the intrinsic difficulty of the problem and, in part, because the treatment of this condition has been, in a measure, relegated to the domain of gymnastics and, to a certain extent, set apart from other surgical deformities and considered as an affection outside of the ordinary surgical principles.

The treatment has consisted, in a large measure, of inadequate and irrational gymnastics sanctioned by tradition and often carried out by persons with a very imperfect knowledge of the subject.

The following statistics¹ collected among school children show lateral curvature of the spine in a surprisingly large percentage of all cases:

	Number of Children.	Per cent. of Scoliosis.
Gulllaume (Neuchatel) . . .	731 (boys and girls)	29
Krug (Dresden)	1,418 (boys and girls)	25
Hagmann (Moscow)	1,664 (girls)	29
Kailbach (Petersburg) . . .	2,333 (girls)	26
Scholder (Lausanne) . . .	2,314 (boys and girls)	24.67

There is no reason to suppose that American children are any less affected than the children in Germany, Russia and Switzerland.

Any pathologic condition which affects 25 per cent. of the children of a community is worthy of serious

* Read before the Surgical Section of the Medico-Chirurgical Faculty of Maryland at Baltimore, Dec. 15, 1905.

1. The data on which much of this paper is based are contained in these articles: R. W. Lovett: Boston Med. and Surg. Journal, June 14, 1900; Oct. 31, 1901; March 17, 1904; Sept. 28, 1905. Also Am. Jour. of Anatomy, vol. II, No. 4, p. 457. Schultness, Schanz and Lovett: Verhandl. d. Deutsch. Gesellsch. f. Orth. Chir., vol. IV.

consideration. The deformity should be considered as a definite surgical problem to be met by adequate surgical means.

In taking up the treatment of this condition it is of great importance to recognize two distinct types which have not been sufficiently separated. These are (1) the postural or functional and (2) the structural or organic type.

THE POSTURAL OR FUNCTIONAL TYPE.

This type of lateral curvature of the spine has been described as "lateral curvature without rotation," faulty attitude, functional malposition and by similar names, all of which are fairly descriptive. It is characterized by a single curve of the spine of slight degree, the deviation of the most divergent of the vertebræ being rarely more than an inch from the median sagittal plane of the body. This median plane of the body is best recognized by holding a string with a weight on its lower end behind the patient which serves as a plumb line falling below in the cleft of the buttocks. The spinous processes of each of the vertebræ should be marked on the skin by ink or a flesh pencil. In the normal spine each one of the marks should lie under the plumb line, and total scoliosis is recognized by a gradual sweep of the vertebral column, most often to the left, 90 per cent. of all cases of total scoliosis being to the left and 10 per cent. to the right.

Taking this, the most common type of postural curvature, the left total curve, the diagnostic points are four.

1. The spine is involved in a gradual sweep, with the convexity to the left, returning nearly or quite to the median line at the top.

2. The left shoulder is high and the right shoulder is low.

3. In looking down on the child from above, the shoulder girdle is seen to be twisted in its relation to the pelvis and no longer lies in the same plane, the right side of the shoulder girdle being carried back and the left side forward. This is clearly seen by standing above the child and sighting the back of the upper thorax against the buttocks, when it will be seen that the right side of the shoulder girdle is further back than the left. This is an expression of the rule that a spine can

not be bent laterally without at the same time twisting.

The attitude is, therefore, a physiologic malposition within the normal movements of the spine and implies no organic change in the vertebræ, ligaments or muscles. Such changes exist, of course, in cases of long standing, but so long as the type described persists there is no evidence of anything further than an exaggerated physiologic position.

4. If the child with a left total scoliosis bends forward until the trunk is horizontal, the right side of the back is generally to be found higher than the left when one glances along the level of the spine from behind or in front. The elevation is very slight and has been the cause of much discussion, having been very imperfectly understood and being described under the names of concave-sided torsion, retro-torsion, etc. It is evidently merely the persistence of the backward twist on the right side described under the previous heading, which is carried over into the position of forward bending. It is to be reproduced with the model or child who stands with the right foot on a book and is within the physiologic limits of the normal movements of the spine. Postural scoliosis is, therefore, best described by the name "faulty attitude," and its treatment is greatly cleared up by this conception. Such postural curves may persist unchanged as total curves, they may be cured, or they may be changed into compound structural curves.

Transitional cases from the postural curves to structural curves are, therefore, to be expected, and it is well to be on one's guard against apparent cases of postural scoliosis in which one or more of the signs described are wanting, as many of these on investigation will be found to be cases changing from postural to structural types.

STRUCTURAL OR ORGANIC LATERAL CURVATURE.

In this form of lateral curvature there is to be found an organic change in the vertebral column and its attached structures. Structural curves may be either single, involving the whole or a large part of the spine, in a curve convex in one direction, or they may be compound (combined), consisting of two curves in different parts of the spine with their convexities in opposite

directions. Even three curves may be seen, one being the principal curve with two curves in the opposite direction, one above and one below. One curve is evidently the primary one and the others are spoken of as secondary or compensatory, although it is not always possible in severe cases to identify the original curve.

The characteristic feature of structural scoliosis is the presence of a backward prominence of the chest or loin on the convex side of the lateral curve, that is the side toward which the spine yields. In the postural scoliosis described above it has been seen that the backward prominence is on the concave side of the lateral curve, that is to say, in a left curve it is on the right side. In structural scoliosis this prominence, on the other hand, is always on the left side in left curves and on the right side in right curves. In extreme cases it forms a very great deformity and can be clearly seen when the patient stands erect. In mild cases the patient must bend forward with the trunk in the horizontal position to enable this so-called rotation to be clearly evident when it is noted in a difference of level of the two sides of the thorax or of the two sides of the lumbar region. This convex-sided rotation is not within the normal mechanism of the spine and is to be regarded as a superadded pathologic phenomenon due to the yielding of the structures forming the vertebral column. In many cases we can assign no better cause for it than to assume an abnormal plasticity of bone in the individual case which has led the vertebræ, under the influence of unequally distributed weight, to yield to one side and in yielding to twist.

In case of every structural lateral curvature, therefore, we have two elements to consider: (1) the lateral curve and (2) the twisting of the vertebræ toward the convexity of the lateral curve (the rotation). The curved region in structural lateral curvature becomes stiff and loses much of its mobility, while distortion of the body outline, prominence of one hip, elevation of one shoulder and a lack of symmetry in various directions are the expression of the condition. The vertebræ are changed in shape, the ligaments and muscles on the convex side shortened, and a very decided resistance to the restoration of symmetry exists in the column and its attached structures. It is evident, therefore, that the same treatment is not re-

quired for the postural and structural cases, and the two varieties of treatment will be discussed separately.

TREATMENT OF POSTURAL SCOLIOSIS.

Defining postural scoliosis as faulty attitude, it is evident that the treatment consists in the substitution of a correct attitude for the faulty one. The prognosis is good for a complete recovery and efficient treatment is satisfactory. The correct attitude is to be obtained by restoring flexibility to the column if it is limited on one side, by exercises consisting of bending to one side, hanging, circumduction of the trunk and similar simple exercises. Having a column flexible in all directions to work on, the patient is then given what amounts to the "setting up drill" of the recruit in the American army. In other words, he is taught to stand correctly by a series of exercises maintaining the erect position. The treatment lies within the range of any good teacher of gymnastics who will carry out the instructions of the surgeon.

The causes of failure are to be found in the fact that such children are generally in poor muscular condition and are often overworked at school or under unfavorable conditions at home. Having placed the patient under the most favorable conditions obtainable and having corrected errors of vision if they exist, having built up a short leg if it is present, having removed the entire weight of the clothing from the tips of the shoulders (where it ordinarily is carried by the child's waist), the patient should work on the exercises described for from half an hour to two hours a day for a period of some weeks. The exercises should not be pushed beyond the limit of fatigue, and after the active period has ceased the child should do home gymnastics and be kept under supervision for at least a year. The length of treatment, the period of the exercises and the extent to which they can be pushed will depend on the vigor of the child, as half-way measures are not likely to be successful and exercises done at home under the supervision of careless parents are less efficient than those given by persons trained in the art of gymnastics.

THE TREATMENT OF STRUCTURAL LATERAL CURVATURE.

The treatment of structural lateral curvature presents a much more serious and much less encouraging

problem than the treatment of postural cases, for reasons which must be self-evident. It must be repeated that there are two elements to be attacked, the lateral curve and the rotation. The spine is stiff in the curved portions, the vertebræ are, to a certain extent, distorted, gravity is at work many hours of the day to continue the deformity, and measures must be vigorous, adequate and surgically sound to produce a permanently satisfactory result. Under good conditions and adequate treatment structural lateral curvature in young children of a moderate grade should be cured, in older children it should be permanently improved, and in adolescents and adults very great improvement in symmetry of a permanent character is to be obtained under efficient treatment.

The causes of failure lie in the unwillingness of the parents or the patient to submit to sufficiently long-continued and effective treatment to remedy a condition which, on the slightest consideration, can be seen to be one which is necessarily difficult and resistant.

The gymnastic treatment has fallen into great disrepute by its careless and indiscriminate use in cases of this class, and the treatment by braces or jackets alone, on the face of it, is unsurgical and inadequate. Merely to hold a stiff column in a position of deformity by a brace or jacket, as is so often done, is no treatment at all and is a detriment rather than a help, because it leads to atrophy of the muscles which are always trying to maintain as erect a position as possible.

The surgical treatment of structural lateral curvature, therefore, must consist of two divisions: First, to loosen up the stiffened parts of the spine to make an improved position possible, and, second, to hold the improved position when it has been rendered possible. These two elements are not sufficiently separated as a rule in treatment; they frequently go hand in hand and treatment must often be simultaneous for both, but it adds very much in a clear formulation of treatment to keep the two things perfectly separate. They will, therefore, be discussed separately.

A. TREATMENT TO LOOSEN UP THE SPINE AND MAKE AN IMPROVED POSITION POSSIBLE.

1. *Gymnastics*.—The object of free standing gymnastics is, by side bendings of the spine to increase

the flexibility of the stiffened portions and to cultivate the muscles which aid in maintaining the erect position. The method is open to the objection that the force exerted is not sufficiently localized, but is distributed over the spine. It is essential that the pelvis should be fixed during such exercises as otherwise the pelvis is displaced and the movement becomes a general and not a local one. So far as lessening the curves in cases of even moderate severity goes, the treatment can not be regarded as wholly efficient and, although perhaps the commonest type of treatment in general use, it is not, as a rule, accompanied by satisfactory results in any but the slighter cases.

Such exercises should be simple and corrective in the strict sense; that is to say, an exercise which is of use should be seen to straighten the spine visibly. Complicated exercises are dangerous and unsurgical. This part of the work lies within the capabilities of any competent, properly educated teacher of gymnastics who will observe the case carefully and will be satisfied to give only exercises which can be seen to secure an improved position. Such work to obtain results must be given by a competent gymnast for a period of from one to three hours a day, according to the vigor of the patient, and must be continued under personal supervision for a period of some weeks to obtain satisfactory results. After this exercises at home can be substituted for part of the personal work.

2. *Gymnastics Given in Apparatus.*—By means of apparatus constructed on the pendulum principle, gymnastic exercises can be very much more correctly localized and the work of loosening the spine and of strengthening the desired muscles can go hand in hand. This method, which is in general use in Germany, has never found a foothold in this country on account of the complicated and expensive apparatus. It is suited to all cases, except the severest, and used for a proper period of time is capable of producing most excellent results.

3. *Passive Stretching of the Spine.*—Passive stretching of the spine with a view to restoring mobility and making an improved position possible in the curved portion is generally secured by hanging by the arms and by traction on the head by means of a Sayre sling. A pull in the length of the vertebral column is not, however, an economical use of force. The hardest way

to straighten a bent stick is to pull the two ends apart, and the easiest way is to press the point of the curve against the knee, while the two ends of the stick are held with the hands. The advantage of traction made on the head in this way lies in the fact that the corrective force is distributed through the whole column.

Apparatus for the purpose has been devised and is known as the Weigel-Hoffa frame in which the patient is suspended by the head, while pads are run in from the sides of the frame, making lateral pressure in various directions. Here, again, the use of force is not economical, as traction in the length of the spine tends to



Fig. 1.—Stretching board with loops, ready for application.

stiffen it against side pressure. In other words, more displacement is possible in a slack than in a stretched spine. Some experiments were made on the cadaver, with a normal spine, where a side pull with twenty-five pounds was made, the pelvis and shoulders being fixed. A traction force of seventy-five pounds was put on the head and a side pull of twenty-five pounds made. Under these conditions it was possible to secure only half as much side displacement of the spine as when traction was not used. A confirmatory experiment was made with a healthy boy of 15, using seventy-five pounds of head traction and fifteen pounds of side pull, and the result was the same.

Traction on the head is, therefore, not an economical

application of corrective force, and when traction is used, lateral corrective force displaces the spine less than when traction is not used.

Stretching of the lateral curve of the spine is, therefore, to be obtained most economically by pressure on the slack spine, which is most easily secured by having the patient lie prone, and the corrective force should be divided into two elements, the force to correct the rotation and the force to correct the side deviation. A simple apparatus for this is as follows (Fig. 1):

The patient lies face downward, with the knees flexed, on a board three feet wide by four feet long. Assuming the case to be of a right dorsal curve, a broad canvas strap is passed around the left upper



Fig. 2.—Stretching board with loops applied to patient.

thorax, over and under the patient, and fastened to a cleat on the right side of the board. This furnishes a point of pressure to the left against the upper thorax at the level of the axilla. A broad canvas strap is then passed around the pelvis of the patient above and below and is fastened to a cleat at the right side of the board. This furnishes a point of pressure to the left at the level of the pelvis. A broad canvas strap is then passed around the thorax at the level of the greatest point of curve; it passes above and below the thorax and its upper end is fastened to a cleat at the left side of the board (Fig. 2). Its lower end is fastened by means of a string into a compound pulley attached to a cleat at the left side of the board. By means of this pulley any reasonable degree of force may be exerted against the right side of the thorax, pulling it to the left and at the same time that it pulls it tends to reduce the rotation

from the fact that its upper end is fastened and its lower end moving toward the pulley.

A better and much more efficient appliance has been made by Dr. Z. B. Adams of Boston.

In this a patient lies prone, with the knees flexed, on a table which is split transversely into five parts. The lower one, on which the pelvis rests, is furnished with two sliding wooden horns which hold the



Fig. 3.—Machine for intermittent correction applied to patient.

pelvis firm. The next three pieces are provided with a pad sliding in from the side and a pad coming down from the top. These three movable pieces slide from side to side and also rotate on a gas pipe running the length of the table longitudinally. The patient is placed in the apparatus, the pads are adjusted to the side and back of the loin or thorax, or both, and by side pressure and a twisting of each arm, both rotation and lateral deviation are corrected separately at each level. In this way it is possible to correct both lateral deviation and rotation at one, two, or three levels for the purposes of stretching the spine by directly applied pressure. The top part of

the table farthest away from the pelvis of the patient is fixed, and on it rest the arms and head.

The patients are stretched daily in this apparatus and left in the corrected position for as long a time as can be borne comfortably, generally from fifteen minutes to half an hour.

4. *Stretching by Means of Plaster-of-Paris Jackets (Forcible Correction).*—In severe cases of structural lateral curvature no means of treatment is so efficient as continuous stretching by means of plaster jackets applied under force. This method is spoken of as "forcible correction." Such jackets are applied in the

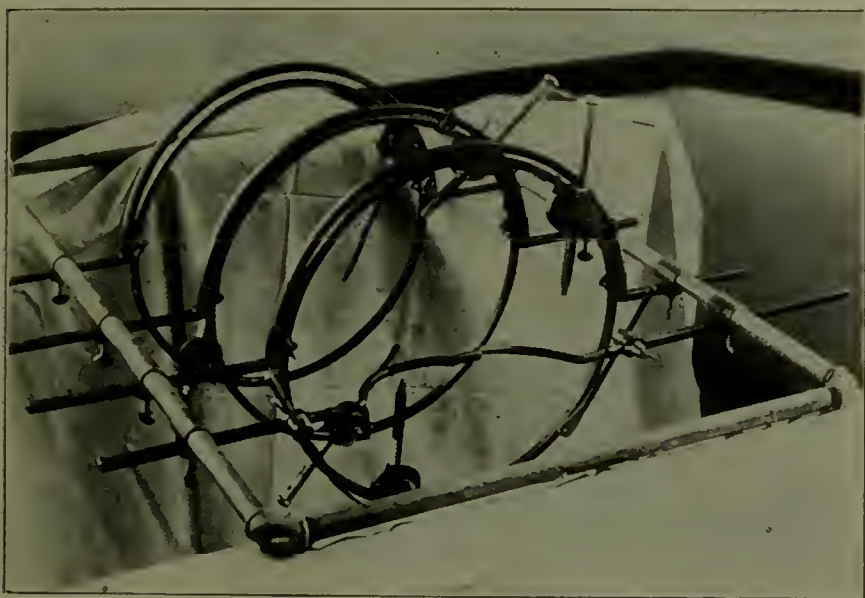


Fig. 4.—Apparatus for forcible correction by plaster jackets.

hope of stretching the contracted structures and of inducing an improvement in the curve. By virtue of their being at work day and night they accomplish much better results than are to be obtained in any other way.

They have been applied, as a rule, to the patients suspended by the head, but the reasons already stated as to the mechanics of this position apply here also.

Corrective jackets should be applied to the patients prone, and preferably with the legs flexed, as this diminishes the physiologic curves of the spine and further simplifies the problem. With a patient thus lying prone, the spine is in the most favorable condition for side correction both as regards side deviation and rotation,

and by an intelligent application of force to correct both of these elements at different levels, in the case of compound curves, great improvement is to be obtained. In this improved position the jacket is applied.

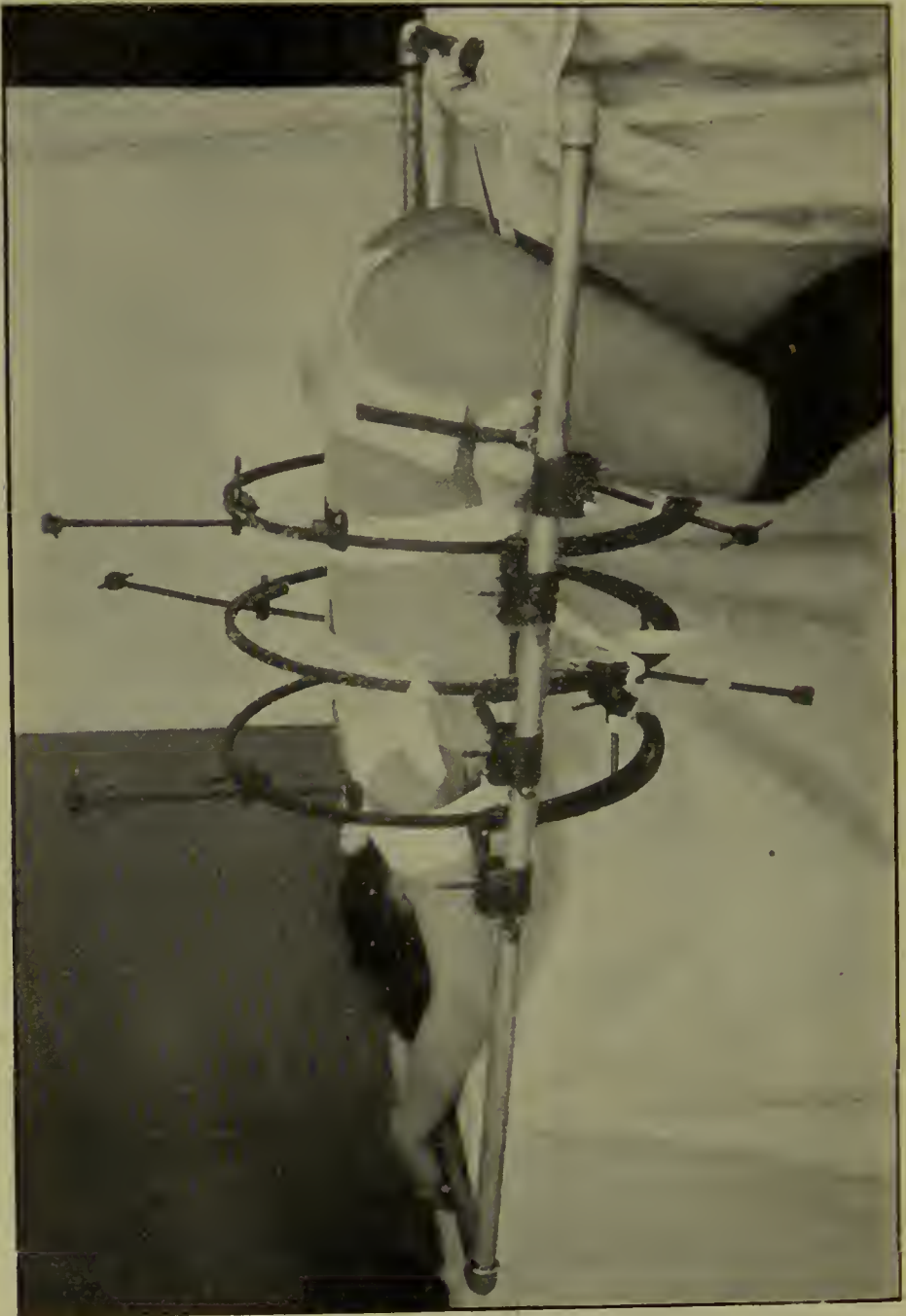


Fig. 5.—Apparatus for forcible correction by plaster jackets applied.

A correct application of this method is to be found by having the patient lie prone in a gas-pipe frame on two straps of webbing running from end to end, cross straps

supporting the pelvis and shoulders. By means of webbing straps attached to the side of the frame, in a right dorsal curve, one going around the left side of the pelvis and another around the left upper thorax, while a third pulls on the right side of the thorax against these as points of resistance, great improvement in the



Fig. 6.—Radiogram of patient 17 years old lying on the back before application of jacket.

position may be obtained, which is secured by the application of a plaster jacket.

A thoroughly efficient apparatus has been devised by Dr. Z. B. Adams as follows:

The apparatus consists of a heavy gas-pipe frame three by four feet. The patient lies face downward on two webbing

strips running from end to end of the frame with the legs flexed. Near the bottom of the frame is an adjustable cross-bar bent to fit into the flexure between the thigh and the pelvis on which the patient rests the lower part of the body. Sliding on this bar are two arms, which slide in and clamp down on the buttocks, holding the pelvis steady on the cross-bar. This bar is movable from side to side in order to induce or correct curvature in the lumbar region when necessary. There are three vertical transverse rings two feet in diameter fastened to pieces on the sides of the frame so that they can be moved to any desired point along the frame. These rings are also movable from side to side and by an independent movement they can also be rotated through a half circle. Any one of these movements can be checked at any point by turning a screw. The shoulders are held by a pair of axillary straps fastened together by a strap across the chest in front. These straps are suspended from the ring nearest to the top of the frame and can be made to hold the shoulders in any desired degree of twist by a rotation of the ring (Fig. 3).

Each ring is provided with two long rods at the two poles of the ring. These rods are adjustable on the ring and can be set at any desired angle to it. They can be pushed up or down and are controlled by a ratchet. By rotating the ring and adjusting the angle of the rods they can be made to press down or up on any part of the back or chest.

For the application of the jacket the patient lies on the face on the two webbing strips, the lower part of the trunk resting on the cross rod and the bars clamping the buttocks; the feet rest on the floor and the arms are extended above the head. The rings are then adjusted at the two levels where it is desired to make correction (Fig. 4). For side correction a bandage is fastened to one side of the ring, carried around the patient's side over a heavy pad of felt, and back to the ring. The same is done to the other ring at the other level where side correction is desired, while the top ring controls the shoulders. The rings are then pulled to one side, the bandages around the patient tighten, and any endurable degree of side correction obtained.

When the side correction is made the ring is rotated till the rods are opposite the points where it is desired to correct rotation. They are then pushed down on to the patient, their points being protected by sheet-iron pads two by three inches, which are covered with heavy felt. These pads are incorporated in the jacket (Fig. 5).

A plaster jacket is applied to the patient held in this way. It is easy to see that the method is perfectly definite and that the amount of force at the operator's disposal is very great.

That a practical gain in the curved part of the spine may be secured by this method is demonstrated by the

two *x*-rays shown in the illustrations (Fig. 6). The patient was a girl of 17, with a severe right dorsal curve, who was extremely rigid and had never been treated. The first *x*-ray was taken with the patient lying on the back. A corrective jacket was applied in the Adams apparatus, the front and back of the jacket were cut away to per-



Fig. 7.—Radiogram of same patient taken after application of plaster jacket through windows cut in front and back of jacket.

mit another *x*-ray, and the improvement in position is evident (Fig. 7).

It seems reasonable to hope that the maintenance of such an improved position may be expected in time to produce a change in the shape of the vertebræ, and such jackets are worn for a period of from one to three weeks. They are then removed and others applied so long as it seems possible to obtain any further corree-

tion (Figs. 8 and 10). This short period is adopted in order to prevent as much as possible the atrophy of the muscles incident to the fixation of the trunk.

The treatment after removal of these jackets will be considered in the next section.

B. TREATMENT TO RETAIN THE IMPROVED POSITION.

Although it may be possible to secure a very great



Fig. 8.—Patient of whom the radlograms were taken before treatment.

improvement in position by means of the measures described, it has been demonstrated clinically that such results are not permanent, and that to become permanent such improved position must be maintained for a long time, and that the ultimate cure must rest in the development of the muscles which maintain the improved position. The intelligent use of gymnastics in this connection is, therefore, of great importance. This consideration of gymnastics is entirely independent of those mentioned before, where they were spoken of

merely as measures to secure flexibility. In this connection they are spoken of as measures to maintain the improved position.

It is impossible to go into the individual exercises, but for practical consideration they may be divided into four types:

1. *Self-Correction Gymnastics*.—With the hands on the head or the hips, the patient lifts herself into a cor-



Fig. 9.—Patient 17 years old, never previously treated, before treatment.

rected position, which she maintains as long as possible, while the arms are taken away from the supporting point. A second type of this exercise is to be found in the so-called “Hoffa self-correction,” in which the patient with a right dorsal curve places the right hand on the thorax and the left hand on the left hip, and by a side pressure presses the right side of the thorax to the left.

2. *Gymnastics for the Contraction of the Muscles on*

the Convex Side of the Lateral Curve.—A distinctive group of exercises intended to maintain the correct position consists in the repeated contraction of the muscles on the convex side of the lateral curve. Such exercises consist of side bendings against resistance and active exercises which are as heavy as they can be made. In a left lumbar curve, for instance, the patient hangs by the hands from a bar and lifts both legs sideways to

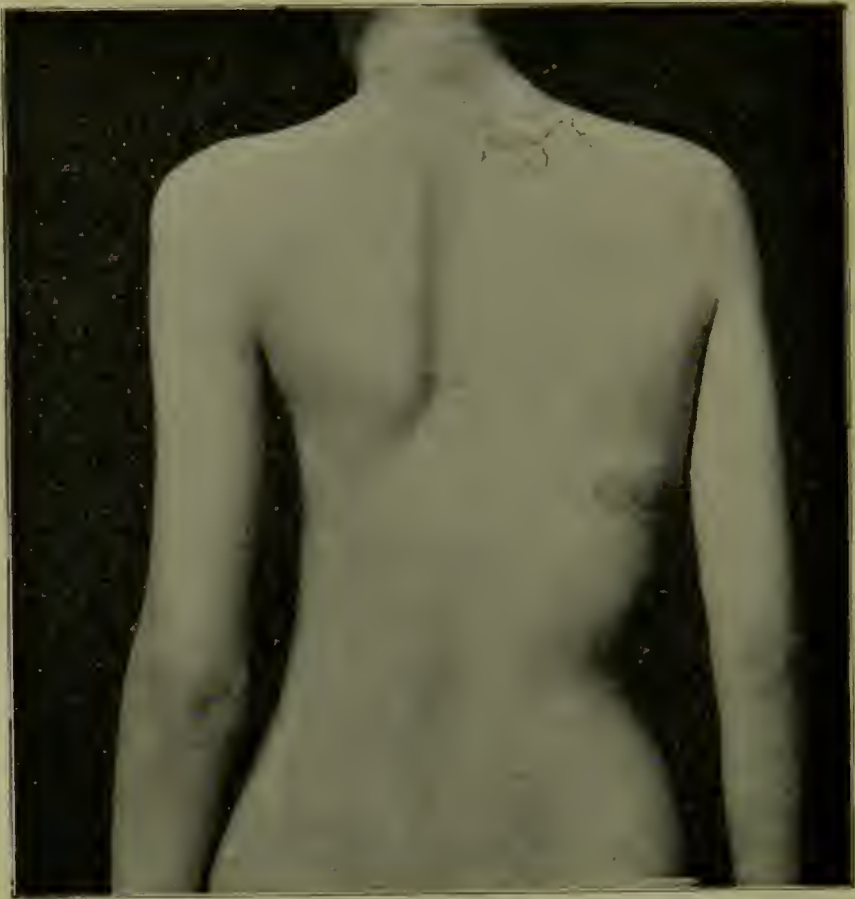


Fig. 10.—Same patient after one corrective jacket.

the left, contracting the left lumbar muscles and straightening the curve.

3. *Backward Bending Gymnastics.*—Backward bendings have been found to have a beneficial effect in maintaining the corrected position. Simple symmetrical backward bendings can be carried out by having the patient lie on the floor, with the feet held, and raising the head and chest with the arms behind the head or on the hips.

4. *Symmetrical Heavy Gymnastics.*—The raising of

heavy bars and weights calling for simultaneous muscular contraction of the two sides is distinctly beneficial in maintaining an improved position of the spine, and, of all the exercises mentioned, is perhaps the safest in inexperienced hands. Dumb bells of from five to ten or twenty to thirty pounds and bars weighing from ten to thirty pounds. Examples of the exercises are as follows: A heavy bell is taken from the floor and raised



Fig. 11.—Same patient after two jackets. Whole interval three weeks.

above the head alternately by each arm, a heavy bar is raised above the head with both arms, and the patient should reach up and look up at the end of each movement, raising the bar to the highest possible point. The patient lies on the back on the floor and raises a bar from the level of the chest to the full extent of the extended arms. In such exercises the patient should be pushed to the limit of fatigue.

Although the exercises have been divided sharply

into four groups, it must be evident that combinations of these groups are likely to be of value, and here again only exercises which can be seen to be corrective should be given. Such work to accomplish results must be carried on from two to four hours a day for a period of at least six months following forcible correction.

The present discredit of gymnastic retentive treatment is due to its use in too small dosage and to a failure to appreciate that a problem so grave as the maintenance of an upright position in a spine, which tends to curve, is to be obtained only by a high degree of muscular development and that this can not be obtained in exercise periods of half an hour, given three times a week, but that treatment must be vigorous and long continued.

5. *Retention by Apparatus.*—After forcible correction either by intermittent means as described or after the removal of jackets furnishing continuous correction, it is desirable that some form of retentive apparatus should be worn for some months (at least, to maintain the corrected position obtained) until the muscles are strong enough to enable the apparatus to be dispensed with.

Braces, as corrective apparatus, have no place in the treatment of severe lateral curvature and should be regarded only as means to retain the gain secured by other measures.

The most easily made and available corset is to be manufactured by removing from the patient the last corrective jacket, filling it with plaster-of-Paris and water, thus securing a torso of the patient. This torso is then further corrected by cutting away the plaster on the convex side and by building up on the concave side so as to secure a symmetrical or overcorrected model, on which a jacket may be applied. It is then shellacked and covered with a layer of stockinet or an undershirt, and a plaster jacket, having been applied on the torso, is cut off, furnished with lacings and supplied to the patient. All plaster jackets applied for forcible correction and retention must embrace the shoulders and even the head should be included, but the disfigurement is so great that most patients are unwilling to submit to it in America.

On the torso obtained as described may be constructed jackets of celluloid, leather or other material. or corsets

made of cloth reinforced by steel. Into the construction of these more complicated forms of apparatus and braces there is no space to enter here. Any brace which maintains the corrected position fulfills the requirement. After a forcible correction it is generally necessary that a jacket should be worn from one to two years and gradually discontinued as the corrected position can be maintained for a longer and longer time.

The gravity of the condition to be met in structural lateral curvature must be recognized and a full appreciation of the very difficult problem that treatment presents is necessary. The failures to secure the results which are possible are to be attributed to our not applying sufficiently vigorous and sound surgical means and to not continuing our treatment for a sufficient period of time. When 20 grains of quinin are needed it is of little use to administer 1 grain, and the reluctance of patients to undergo adequate and long-continued treatment for the result of a deformity which does not threaten life is, and always will be, an obstacle to the generally successful treatment of this deformity.

